FACT SHEET

L-913

# SELECTING DAIRY SIRES

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The current DHI Sire Summary is a valuable tool for selecting dairy sires to improve genetic inheritance for milk and fat production. A study by Dr. Frank Dickinson, USDA, shows that genetically superior sires can increase income over feed cost by approximately $3.22 in the first lactation for each 100 pounds of milk in the sire's predicted difference (based on milk @ $5.50 cwt. testing 3.5%).

If a dairyman raises his own replacements, about one-third of the herd 3 years later will be made up of heifers resulting from matings the first year. Four years later about two-thirds of the herd will contain cows resulting from matings the first and second years. Five years later, 80 to 90 percent of the herd will be offspring from matings made the next three years. If $3.22 is applied to a herd of 50 cows using genetically superior sires with predicted differences of +600 pounds milk, the expected increase in income above feed cost would be: 3 years hence, $480; 4 years hence, $1,020; 5 years hence, $1,350.

The DHI Sire Summary is compiled three times a year — January, May and September — by the USDA from DHI and DHIR records from all states. USDA prepares one bound Summary volume each year and distributes a limited number of copies to Extension dairymen in each state. In Texas, copies are mailed to DHI supervisors with the request that they be made available to DHI members and others who wish to see them.

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**Example DHIA Sire Performance Summary for Texas**

| Reg. Number | Code Number | Barn Name | Date of Summ. | Number of Hds. | Number of Das. | Daughters Avg. Prod. Milk | Daughters Avg. Prod. % | Daughters Avg. Prod. Fat | Predicted Difference Milk | Predicted Difference Fat | % Repeatability | Das. | Type Score | Dif/Exp |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| A | B | C | D | E | F | G | H | I | J | K | L | M | N | O |
| 1426451 | 4H290 | MILKYWAY | 09-69 | 68 | 78 | 14811 | 3.44 | 509 | +650 | + 7 | 81 | 21 | 80.1 | +4.65 |
| 1463169 | 4H305 | TRIUMPH | 09-69 | 31 | 36 | 15168 | 3.59 | 545 | +589 | +22 | 64 | 18 | 78.3 | + .10 |

**A—Registration number as recorded in Breed Herdbook.**
**B—Code number as assigned by A.I. unit.**
**C—Barn name as assigned by A.I. unit.**
**D—Month and year the summary was tabulated by USDA.**
**E—Number of herds in which daughters were tested.**
**F—Number of tested daughters with herdmates.**
**G—Average pounds of milk of daughters (305-day M.E.).**
**H—Average percent butterfat of daughters.**
**I—Average pounds butterfat of daughters (305-day M.E.).**
**J—Predicted difference in pounds milk as compared to herdmates of breed average.**
**K—Predicted difference in pounds fat as compared to herdmates of breed average.**
**L—Repeatability of this summary to future summaries in percent.**
**M—Number classified daughters.**
**N—Average type score of classified daughters.**
**O—Measure of type reported for some sires.**



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A computer print-out also is mailed to each Extension dairyman when the USDA completes the listing in January, May and September. A.I. sires available to Texas dairymen are selected from each print-out. This information is then published in the "DHIA Sire Performance Summary for Texas" and made available to all dairymen through county Extension offices.

### Daughter-Herdmate Comparisons

The Sire Summary is based on daughter-herdmate comparisons. Records made by the daughters of the sire summarized are compared to records of herdmates. Herdmates are other cows of the same breed, in the same herd, sired by a different bull, and freshening in the same season of the year. Since daughters and herdmates are making their records in the same herd at essentially the same time, environmental differences are greatly reduced. This is especially significant when we consider that approximately 75 percent of a cow's production normally can be attributed to the feed and treatment she receives.

A recent report by Dr. J. E. Legates of North Carolina illustrates the error involved in daughter-dam comparisons. A bull which had a +2,172 pounds milk on daughters over dams was found to have +639 milk difference on daughters over herdmates. A study of the records shows that during the period when the daughters were born and when they completed their first records, the average production of herds involved had increased 1,700 pounds of milk thus causing the value difference. Daughters of the sire made up less than 5% of the records involved. Therefore, the big difference was caused by environmental change, not genetic improvement. Comparing cows on two different farms or at two different periods tends to measure the ability of the dairyman and changes in environment rather than only the animal's true genetic value.

### Predicted Difference and Percent Repeatability

*Predicted difference* is the best available estimate of a sire's ability to transmit production. It is the amount of milk and fat that a sire is expected to raise or lower in his daughter's production in comparision with herdmates at breed average levels. Sires with a plus difference are expected to excel those with a minus difference when used in herds representing any production level. Predicted difference is determined by: (1) repeatability; (2) daughter's average; (3) adjusted herdmate average; (4) number of herdmates; (5) percent incomplete records; and (6) adjustments for age, season of calving and geographical region.

The following table shows expectations from daughters of various sires used in herds at different levels of production. Regardless of herd production level, the best choice is to use the sire with the highest predicted difference. It is a fallacy to believe that negative bulls are good enough to improve below-average herds.

| PRED. DIFF. OF SIRE | YOUR HERD AVERAGE (305-2x-M.E.) 10,000 | 12,000 | 14,000 | 16,000 |
|---|---|---|---|---|
| | EXPECTED DAUGHTER AVERAGE (305-2x-M.E.) | | | |
| +1200 | 11,500 | 13,300 | 15,100 | 16,900 |
| + 800 | 11,100 | 12,900 | 14,700 | 16,500 |
| + 400 | 10,700 | 12,500 | 14,300 | 16,100 |
| 0 | 10,300 | 12,100 | 13,900 | 15,700 |
| — 400 | 9,900 | 11,700 | 13,500 | 15,300 |
| — 800 | 9,500 | 11,300 | 13,100 | 14,900 |
| —1200 | 9,100 | 10,900 | 12,700 | 14,500 |

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Also, a possible rule for an individual herd is to reduce the predicted difference by 100 pounds of milk for every 1,000 pounds the herd exceeds breed average. For every 1,000 pounds of milk the herd is under breed average, add 100 pounds to the predicted difference.

**Example**

| | | | |
|---|---|---|---|
| Breed Average | 13,000 | Predicted Increase | 1,000 |
| Herd Average | 14,000 | Predicted Increase | 900 |

Nationwide DHI Breed Averages (2X-M.E.) for 1966-67 were:

| | Milk | Fat |
|---|---|---|
| Ayrshire | 10,990 | 431 |
| Guernsey | 9,508 | 442 |
| Holstein | 13,832 | 499 |
| Jersey | 8,756 | 439 |
| Brown Swiss | 12,122 | 488 |
| Milking S'horn | 9,671 | 356 |

*Percent Repeatability* is an accuracy measure of predicted difference. Percent repeatability does not indicate how good a bull is but it does indicate the accuracy of proof at the level his daughters have produced. A sire's repeatability will always increase correspondingly with (1) number of herds (2) number of daughters and (3) number of records per daughter. The following example shows how distribution of daughters affects repeatability.

| | | |
|---|---|---|
| 10 daughters in 1 herd | = 13.6% | repeatability |
| 10 daughters in 10 herds | = 33.3% | repeatability |
| 50 daughters in 1 herd | = 23.3% | repeatability |
| 50 daughters in 50 herds | = 71.4% | repeatability |
| 200 daughters in 1 herd | = 24.8% | repeatability |
| 200 daughters in 200 herds | = 90.9% | repeatability |

## Which Bull Is the Best Choice?

*Always consider predicted difference and percent repeatability to indicate the best choice of a bull.* The sire with the highest predicted difference is usually the best transmitting sire for production. It is easy to choose between top and bottom sires; however, the choice is less clear between two close-ranking bulls with wide differences in repeatability. Use Tables 1 and 2 for making such a choice.

To use the tables, locate repeatability percentage at the top. Find the predicted difference of a bull on the left. The value where the two lines meet is the bull's probability above breed average for genetic milk production ability.

For an illustration of use of the two tables, assume that a decision is to be made between Holstein bulls A and B with the following information in the Sire Summary.

| Bull | Predicted Difference | Repeatability % |
|---|---|---|
| A | 400 | 20 |
| B | 200 | 70 |

Using Table 1, note that bull A is a slightly better choice (**bold face numbers**). There is a 79 percent chance that bull A's daughters will be above breed average compared to a 74 percent chance for daughters of bull B.

**TABLE 1**

**APPROXIMATE PROBABILITY THAT A HOLSTEIN OR BROWN SWISS BULL[1] WITH A GIVEN REPEATABILITY AND PREDICTED DIFFERENCE HAS A TRUE GENETIC MERIT ABOVE BREED AVERAGE.**

| Predicted Difference, Milk | Repeatability | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 15 | 20 | 25 | 30 | 35 | 40 | 45 | 50 | 60 | 70 | 80 | 90 | 95 |
| (lb) | % | | | | | | | | | | | | |
| +1000 | 98 | 98 | 98 | 98 | 99 | —[2] | — | — | — | — | — | — | — |
| +900 | 96 | 97 | 97 | 97 | 98 | 98 | 99 | — | — | — | — | — | — |
| +800 | 94 | 95 | 95 | 96 | 96 | 97 | 97 | 98 | 99 | — | — | — | — |
| +700 | 91 | 92 | 93 | 93 | 94 | 95 | 96 | 96 | 98 | 99 | — | — | — |
| +600 | 88 | 89 | 89 | 90 | 91 | 92 | 93 | 94 | 96 | 98 | 99 | — | — |
| +500 | 84 | 84 | 85 | 86 | 87 | 88 | 89 | 90 | 92 | 95 | 98 | 99 | — |
| +400 | 78 | **79** | 80 | 81 | 81 | 82 | 83 | 85 | 87 | 91 | 95 | 99 | — |
| +300 | 72 | 73 | 73 | 74 | 75 | 75 | 77 | 78 | 80 | 84 | 89 | 96 | 99 |
| +200 | 65 | 66 | 66 | 66 | 67 | 68 | 68 | 69 | 71 | **74** | 79 | 87 | 95 |
| +100 | 58 | 58 | 58 | 58 | 59 | 59 | 59 | 60 | 61 | 63 | 66 | 71 | 79 |
| 0 | 50 | 50 | 50 | 50 | 50 | 50 | 50 | 50 | 50 | 50 | 50 | 50 | 50 |
| −100 | 41 | 41 | 41 | 41 | 40 | 40 | 40 | 39 | 38 | 36 | 33 | 28 | 20 |
| −200 | 34 | 33 | 33 | 33 | 32 | 31 | 31 | 30 | 28 | 25 | 20 | 12 | 4 |
| −300 | 27 | 26 | 26 | 25 | 24 | 24 | 22 | 21 | 19 | 15 | 10 | 3 | 0 |
| −400 | 21 | 20 | 19 | 18 | 18 | 17 | 16 | 14 | 12 | 8 | 4 | 0 | 0 |
| −500 | 15 | 15 | 14 | 13 | 12 | 11 | 10 | 9 | 7 | 4 | 1 | 0 | 0 |
| −600 | 11 | 10 | 10 | 9 | 8 | 7 | 6 | 5 | 3 | 1 | 0 | 0 | 0 |
| −700 | 8 | 7 | 6 | 6 | 5 | 4 | 3 | 1 | 0 | 0 | 0 | 0 | 0 |

[1]Assuming standard deviation among bulls of 550 lb.
[2]Dashes indicate probability over 99%.
USDA - DHI Letter 4-68

Be sure to check the number of herds involved with the low repeatability percent. If all daughters are in one or two herds, there is a greater chance of a "stacked deck" by giving preferential treatment to the daughters.

**TABLE 2**

**APPROXIMATE PROBABILITY THAT AN AYRSHIRE, JERSEY, OR GUERNSEY BULL[1] WITH A GIVEN REPEATABILITY AND PREDICTED DIFFERENCE HAS A TRUE GENETIC MERIT ABOVE BREED AVERAGE.**

| Predicted Difference, Milk | Repeatability | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 15 | 20 | 25 | 30 | 35 | 40 | 45 | 50 | 60 | 70 | 80 | 90 | 95 |
| (lb) | % | | | | | | | | | | | | |
| +1000 | 99 | —[2] | — | — | — | — | — | — | — | — | — | — | — |
| +900 | 99 | — | — | — | — | — | — | — | — | — | — | — | — |
| +800 | 98 | 99 | — | — | — | — | — | — | — | — | — | — | — |
| +700 | 97 | 97 | 98 | 98 | 98 | 99 | — | — | — | — | — | — | — |
| +600 | 95 | 95 | 96 | 96 | 97 | 97 | 98 | 98 | 99 | — | — | — | — |
| +500 | 91 | 92 | 92 | 93 | 94 | 95 | 95 | 96 | 98 | 99 | — | — | — |
| +400 | 86 | 87 | 87 | 88 | 89 | 90 | 91 | 92 | 94 | 97 | 99 | — | — |
| +300 | 79 | 80 | 81 | 81 | 82 | 83 | 84 | 85 | 88 | 91 | 95 | 99 | — |
| +200 | 70 | 71 | 72 | 72 | 73 | 74 | 75 | 76 | 78 | 82 | 87 | 94 | 99 |
| +100 | 60 | 61 | 61 | 61 | 62 | 62 | 63 | 53 | 65 | 67 | 71 | 78 | 87 |
| 0 | 50 | 50 | 50 | 50 | 50 | 50 | 50 | 50 | 50 | 50 | 50 | 50 | 50 |
| −100 | 39 | 38 | 38 | 38 | 37 | 37 | 36 | 36 | 34 | 32 | 28 | 21 | 12 |
| −200 | 29 | 28 | 27 | 27 | 26 | 25 | 24 | 23 | 21 | 17 | 12 | 5 | 0 |
| −300 | 20 | 19 | 18 | 18 | 17 | 16 | 15 | 14 | 11 | 8 | 4 | 0 | 0 |
| −400 | 13 | 12 | 12 | 11 | 10 | 9 | 8 | 7 | 5 | 2 | 0 | 0 | 0 |
| −500 | 8 | 7 | 7 | 6 | 5 | 4 | 4 | 3 | 1 | 0 | 0 | 0 | 0 |
| −600 | 4 | 4 | 3 | 3 | 2 | 2 | 1 | 1 | 0 | 0 | 0 | 0 | 0 |
| −700 | 2 | 2 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

[1]Assuming the standard deviation among bulls is 400 lb.
[2]Dashes indicate probability over 99%.
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## Classification and Selection for Type

The assignment of a numerical score by an official classifier is used to indicate the physical characteristics of an animal. Composite score for the animal is used to determine a descriptive name for type.

| Type | Description | Score |
|---|---|---|
| (E) | Excellent | 90 or more |
| (VG) | Very Good | 85 to 89 |
| (GP) | Good Plus (desirable) | 80 to 84 |
| (G) | Good (acceptable) | 75 to 79 |
| (F) | Fair | 65 to 74 |
| (P) | Poor | 64 or less |

Type classification scores may vary for the same animal at different ages. Breed age average scores are sometimes used for comparison. Each animal's score also can be evaluated in relation to other animals of the same age by calculating the breed age average percent (BAA percent). For example, a 4-year-old Holstein cow scoring 84 would have a BAA percent of 104.4 (breed age average for 4-year-old Holsteins is 80.7; therefore, 84 ÷ 80.7 = 104.1 percent).

The usual measure of type published for Holsteins is difference from expectancy, a point halfway between the dam's BAA percent and breed average at 100 percent. For example, a cow with a BAA percent of 102 would have an expectancy for her daughters of 101.

Difference from expectancy is reported for some sires. It is a comparison of the calculated expectancy with the actual score of the daughters. Expectancy minus BAA percent equals the difference from expectancy. The following example may visualize these terms and the difference from expectancy from a sire.

BAA for dams = 101.8
Expectancy = (101.8 — 100) ½ = 100.9
BAA for daughters = 99.6
Difference from expectancy = 100.9 — 99.6 = —1.3

Type information is available from breed associations or A.I. organizations.

## Summary

Tremendous opportunities for genetic improvement of dairy cattle are ever-increasing with applied knowledge. The DHI Sire Summary is the best tool that dairymen have ever had to improve their herd for milk and fat production. The precise result of an individual mating never can be predicted with absolute accuracy.

However, dairymen who make their livelihood from milk sales should breed their herd to the best production-proved sires available. Each dairyman must decide for himself the emphasis to place on production and on other traits.

Suggestions for maximum gain:

1. Select six or seven sires with predicted differences of at least +400 pounds milk (high testing breeds, +200 pounds milk) and repeatability of at least 60 percent.
2. From this group, select three or four sires that appear to be siring other desirable traits. Breed two-thirds of the herd to these bulls.
3. Breed the remainder of the herd to three or more highly promising young sires with low repeatability, but with high predicted differences of plus 900 pounds milk (high testing breeds, plus 450 pounds milk). Using more than one young sire will spread the risk of possible disappointment and at the same time increase the chance of using a sire with truly superior inheritance.
4. *Raise, milk and test all heifers.*

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